

*Trap Dykes in the Archæan Rocks of Southeastern Pennsylvania.*  
By Dr. Persifor Frazer.

(Read before the American Philosophical Society, October 17, 1884.)

Among the geological papers announced to be read in Section E of the late meeting of the American Association for the Advancement of Science, in Philadelphia, was one by Prof. Henry Carvill Lewis on a Trap dyke in Eastern Pennsylvania. It describes a dyke which (its author asserted) had been overlooked by the speaker and other geologists in this portion of the State, and which was distinguished, both by its great length and by certain peculiarities of position,\* from other dykes in Pennsylvania.

This faulted dyke is supposed to have been laterally thrown for a distance that was understood to be five miles as Prof. Lewis described it. But on hearing that the "hade" or dips were nearly vertical in both parts which it was thought were once in contact, Prof. James Geikie thought that any previous continuity of the two dykes must be abandoned.†

In describing the course of his dyke, Prof. Lewis remarked, "Dr. Frazer failed to trace it through Chester county, though he has a small portion of it on his geological map in Easttown township; nevertheless I have followed it over the surface, foot by foot, by the loose boulders on the surface; and found it to be continuous," or words to this effect.

There happened to be on the wall the joined maps of the four counties which the speaker had prepared for the Second Geological Survey, viz: Adams, York, Lancaster and Chester, and he referred to them as follows:‡

The great amount of disintegration of the surface rocks of Chester county has caused a deep soil, which overlies a large portion of the rocks of the county on the line of this dyke, and the constant movement of this soil renders it very difficult to trace the buried outcrops by loose boulders and fragments. The consequence of this is that if one maps all the localities where masses of trap are found, and attempts to connect them by lines, the irregularity of the latter will inform him that he is probably not representing the facts of structure as they exist. In Adams county, where the decomposition is generally much less profound than in Chester, in the

\* The text of this paper is not at hand and the writer must trust his memory for its contents. It is very unfortunate that in the reports of the proceedings of Sections of the A. A. A. S., there should be no account taken of the discussions on papers; especially in cases where statements are observed and pointed out which seem to be at variance with a cautious judgment of the facts. The disadvantage of this state of things to the cause to which the Association is nominally devoted is still further increased by the long period which must elapse before a paper finds its way into print. Error is notoriously fleet of foot, and with a year's start may defy pursuit.

† In a rather exceptionally full notice of this paper (omitting however mention of the objections to it) given in *Science* subsequently, the fault is stated to be several thousand feet, but the extent of the lateral displacement is mentioned only as "large."

‡ The following remarks are quoted from memory and somewhat amplified.

region of the dykes, a great deal of work was necessary before the seemingly capricious outcrops could be brought into anything like order. Let any one look at the regularity of the three threads of trap passing from N. E. to S. W. on the map of Adams county of the First Geological Survey, and compare it with the irregular and broken lines of the trap in the map of the same county by the present Survey, and he will find a case in point.

It will not suffice to find three or four occurrences of fragments of trap, lying more or less in a straight line, in a distance of a mile or more, in order to assume a dyke of trap connecting them under the soil.

On looking over the maps of the townships south of the Chester valley, which the speaker carried into the field when engaged in the Geological Survey, he remarks in a great many places notes of trap fragments on the surface. But with some experience in tracing the outcrop of this rock, he did not feel justified in connecting these isolated indications together, and he still doubts whether this should be done. The absence of a map of the dyke prevents him from saying how many of these occurrences are included within the dyke mentioned by Prof. Lewis, but no single dyke can include many of them.

It is a very different matter if it is merely claimed that this supposed new dyke indicates the direction of a zone or belt of disturbance along which two, twenty, or fifty outbursts of igneous rock may have taken place, just as it is shown that in north-western York and central Adams counties, notwithstanding all the irregularity of the outcrops, there is a general zone along which the main outflows have taken place.

The considerations which the speaker has so often urged in connection with this region, make the existence of such a belt exceedingly probable. (See *Mémoire sur la partie S. E. de la Pennsylvanie*, pp. 90, 109+, etc.) It has been abundantly urged, both in this memoir and elsewhere, that the exceedingly straight southern limit of the Chester valley implies other causes at work than those of ordinary deposition: in other words, a great longitudinal crack along the southern side of which the lower measures were brought up; that this great crack would in all probability be connected with others crossing or diverging from it hardly needs to be stated; but if the speaker was unable to represent this line of fracture by a single well defined dyke, there are abundant allusions both to outflows of trap and to the existence of a belt of dislocation, as the following from C<sub>4</sub>\* will show, p. 286. "The trap dyke, traceable only by its broken fragments† on the surface, which has been alluded to as occupying the southern edge of *Tredyffrin* township, enters *Easttown*," etc. (here follows a detailed statement of its course), \* \* \* "when its traces cease to be apparent, though a few scattering boulders and fragments of trap are met with."‡

\*Geology of Chester county, Persifer Frazer, edited by J. P. Lesley.

†Of course, a trap dyke may be assumed when the whole ground is made up of the larger or smaller fragments, but the question how many trap fragments will enable one to assume the presence of a dyke is, like many others, not capable of a general answer.

‡The trap here referred to is part of the "great dyke" which forms the subject of the paper above alluded to.

In the succeeding township, *Willistown*, it is stated of the rocks: “\* \* \* Southernmost of all, a broad band of syenitic granite and hornblendic gneiss, in which latter are dykes of dolerite (as near Lukens’), and another band of serpentine. How would these facts agree with the hypothesis hinted at above, that the lower Primal was represented by the pseudo-quartz porphyry and feldspar porphyry; that this was overlain by the quartzite proper; this by schists, and this by limestone; that there had been first a synclinal valley of all these, and finally a break in or on the side of the valley, by means of which the lower measures had been thrown up on the south and planed off evenly,” etc.

Under *West Goshen* township “fragments of dolerite are frequent, but no *dyke* was apparent.” In the description of *West Marlborough* township, “Syenite apparently belonged to a dyke, of which the exact position was not determined,” is noticed south of Doe run, and “loose pieces of dolerite were deemed insufficient to warrant the placing of this formation on the colored map” (p. 307). In the description of *East Nottingham*, fragments of syenite are mentioned, &c., &c. (p. 343).

In addition to the above references in the text of  $C_4$  to trap, there are marks in the following localities on township maps used in the field by the speaker, which indicate the presence of igneous rock fragments which were not placed upon the county map because not sufficiently indicative of the position of the parent dyke: *East Goshen*, N. E., N. and N. W. of Goshenville; *West Goshen*, near water works; *East Bradford*, near Copesville; *East Marlborough*, near Unionville; *West Marlborough*, S. W. and N. W. of Upland, near and W. of Woodville, etc.; *Lower Oxford*, near Lincoln University, etc.; *Easttown*; *Willistown*, near White House P. O., N. and N. W. of Sugartown; *Highland*, near Gum Tree and near Fairview School House; *Kennett*; *New Gardon*, near Toughkenamon, etc.

It is not pretended that these citations cover all the places where trap was found, but they will serve to indicate that in the opinion of some field workers, there is a long step to be taken from the occurrence of a number of trap fragments on the surface to the establishment of a dyke in place.

Prof. Lewis concluded his description by saying, that such a dyke would form an important feature in the geology of the State. In this the speaker agreed with him, though whether or not the line of the trap be as continuous as he has represented it, the belt of disturbance had been established long ago.

But this dyke, if established, would be singularly confirmatory of the long fault and southern upthrow, which constitute the kernel of the speaker’s hypothesis of the structure of the rocks in Southeastern Pennsylvania: for, that there should be a fracture filled with injected rock, following just the course which the speaker has ever maintained the fault to occupy, for “ninety miles;” and that the upthrow in one place (not in Chester county) was, “several thousand feet,” in extent, would be clearly corroboratory of the speaker’s view.

The position of this belt is indicated,  $C_4$  (*l. ci.*), as follows: \* \* \*  
 "These slates are bordered by a great belt of serpentine, of which the northern boundary is nearly parallel with the southern margin of the limestone itself, as if the mass of schists intervening had about a uniform thickness, and that the serpentine were a true contact formation occurring between these schists and the lower rocks."

Attention was drawn to another statement of Prof. Lewis, viz: that the lithological characteristics of this dyke were constant throughout its range. This was entirely at variance with the speaker's observation. There were strongly marked differences of texture, structure, and constitution between many of these outcrops in the townships south of the Chester valley, and near Conshohocken.

*On Herderite. By F. A. Genth.*

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In the American Journal of Science [3], xxvii, 135-138, in an article on Herderite, by William Earl Hidden and James B. Mackintosh, the latter published his analysis of this rare mineral from Stoneham, Me. In a letter to the editors of the "Neue Jahrbuch der Mineralogie, &c.," of 1884, ii, 134-136, Professor A. Weisbach gives the results of a comparative examination of the *original* herderite from Ehrenfriedersdorf, Saxony, and of that of Stoneham, Me., made at his suggestion by Dr. Cl. Winkler.

These investigations, showing remarkable discrepancies not only between Dr. Winkler's analyses of the herderite from the two localities, but also between those of the two analysts of the Stoneham mineral, it was desirable to re-examine this interesting species.

I am under great obligations to Mr. George F. Kunz, who has kindly furnished me with the material for this investigation, from which I was able to pick out over 2.5 grms. of pure crystals.

Referring to the occurrence of herderite, he has sent me the following communication, dated New York, October 14th, 1884:

"On revisiting the Stoneham locality I found that the herderite had all been obtained from a vein of margarodite, four feet wide, about twenty feet long, worked to a depth of ten feet. This vein is on the side of the top of Harndon hill, about one hundred feet from the place where was found the topaz obtained by me (see Proceedings New York Academy of Science, November and December, 1882, and American Journal of Science, Feb., 1883), and not in the same pocket, as stated in the article, in the American Journal of Science, Jan. 7, 1884. The vein is almost entirely margarodite, occurring here in unexampled crystals. These at times cover spaces four or five inches square with distinct perfect crystals of margarodite, also altering to serpentine, and associated with it what is possibly topaz, altered into serpentine.

"The herderite occurs almost invariably in crystals, implanted on the margarodite, crystals of quartz, and in a few instances on columbite.

"Between the herderite vein and the topaz vein worked by me were found the large columbite and triplite. Two distinct crystals of triplite have been found recently.

"Signed,

GEORGE F. KUNZ."